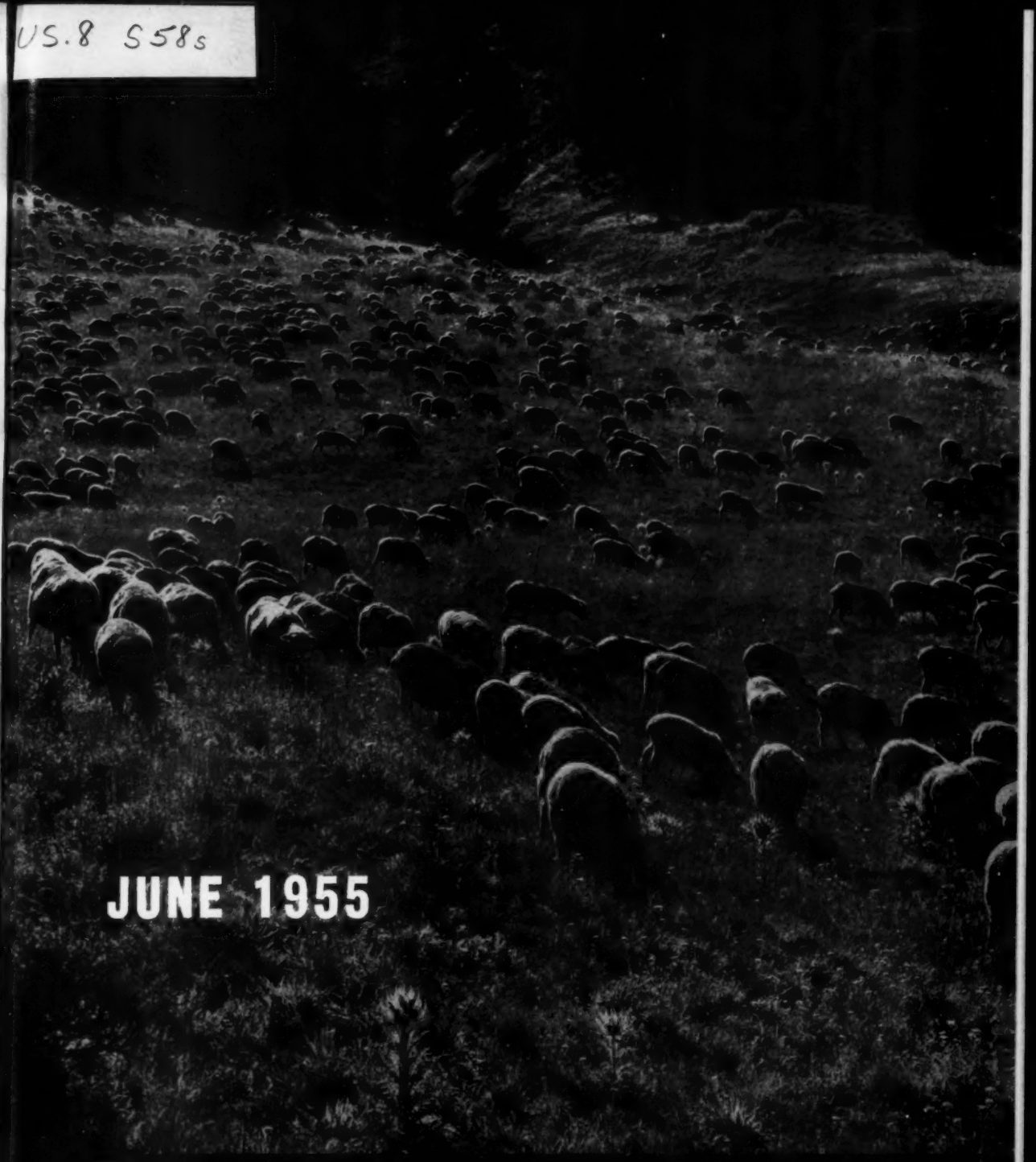
US.8 S58s



JUNE 1955

SOIL CONSERVATION

Soil Conservation Service • U. S. Department of Agriculture

SOIL CONSERVATION

JUNE 1955

VOL. XX—NO. 11

EZRA TAFT BENSON
SECRETARY OF AGRICULTURE

DONALD A. WILLIAMS
ADMINISTRATOR, SOIL CONSERVATION SERVICE

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE, U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

★ THIS MONTH ★

	PAGE
WHEN THE RAINS COME *By George W. Musgrave*	243
WHICH WAY BLOWS THE WIND? *By C. D. Brehm*	246
SOIL AND WATER CONSERVATION IN ACTION *By D. A. Williams*	249
A LOOK AT OLD LANDS AND NEW PROBLEMS *By Edward H. Graham*	252
RADIOACTIVE ISOTOPES HELP SOLVE FIELD PROBLEMS *By J. C. Brown and R. S. Holmes*	259
BRUSH CONTROL *By Harlan N. Tulley*	262
FLOODS—A Review *By Victor Mockus*	263
BIG JOB WELL DONE!	264

WELLINGTON BRINK
Editor

SOIL CONSERVATION is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business. The printing of this publication has been approved by the Bureau of the Budget, July 29, 1954. SOIL CONSERVATION supplies information for workers of the Department of Agriculture and others engaged in soil conservation.

15 CENTS PER COPY

$1.25 PER YEAR

FOREIGN—$1.75 PER YEAR

25 percent discount on orders of 100 or more subscriptions mailed to a single address

"PROGRAM OF GREATER SERVICE."—District supervisors of the Savannah Valley (S. C.) Soil Conservation District in the past year provided approximately $100 worth of conservation literature to the libraries of each of the four high schools in the county. Each of the six Garden Clubs in the county participated by contributing to the purchase fund.

NEW ROTATION.—Joe Edwards, of Smithboro, farmer and supervisor of the Marion (S. C.) Soil Conservation District, is trying a new tobacco rotation. He is setting tobacco behind small grain and fescue. The small grain is combined and the fescue turned into the land after a year's growth. By turning under litter and stubble Edwards expects to increase his yields without irrigation.

Editors are invited to reprint material originating in this magazine.

FRONT COVER.—A band of sheep, well spread out and grazing contentedly, on privately-owned range in Madison County, Mont.

All orders go to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

When the Rains Come

By GEORGE W. MUSGRAVE

I WAS talking to my fortunate friend Joe, who owns and operates a nice farm, when he asked me about that piece I wrote on the different things that happen in soil when it rains. Joe had a good question. He wanted to know how much the water-holding capacity of the soil affected intake. He was concerned about a large amount of talk he had heard about increasing the water-holding capacity. How much can we increase it and what would be the effect?

I had to answer, "Not as much as a lot of folks think. But since this is a bit complicated, let's look at the results of several storms on your farm. Maybe you won't mind if I oversimplify a little."

His farm has nice silt loam, quite uniform originally. But a back forty has been in corn most of the time in recent years and is beginning to show some bad effects. A front forty near the buildings and highway has been in a good rotation and occasionally manured too. It happens that the College and some of our SCS boys have been studying those two fields. Some actual figures about the soil were at hand.

The soil in the back forty that has been "corned" so much, weighs more and has less pore space than that in the front forty. It weighs 78 pounds to the cubic foot while the other weighs 73 pounds. It has 52 percent pore space in it as against 55 percent for the field in rotation. It also has much more of its soil in small crumbs or aggregates. They are about the size of sand grains and give the soil a nice crumbly structure. The figures show 24.7 percent of this soil is in crumbs as against only 10.7 percent in the back forty.

These small aggregates or crumbs have larger pores among them than are found in the field that was "corned" so much. Water enters and moves more readily in such soil, somewhat as it does in a sandy soil.

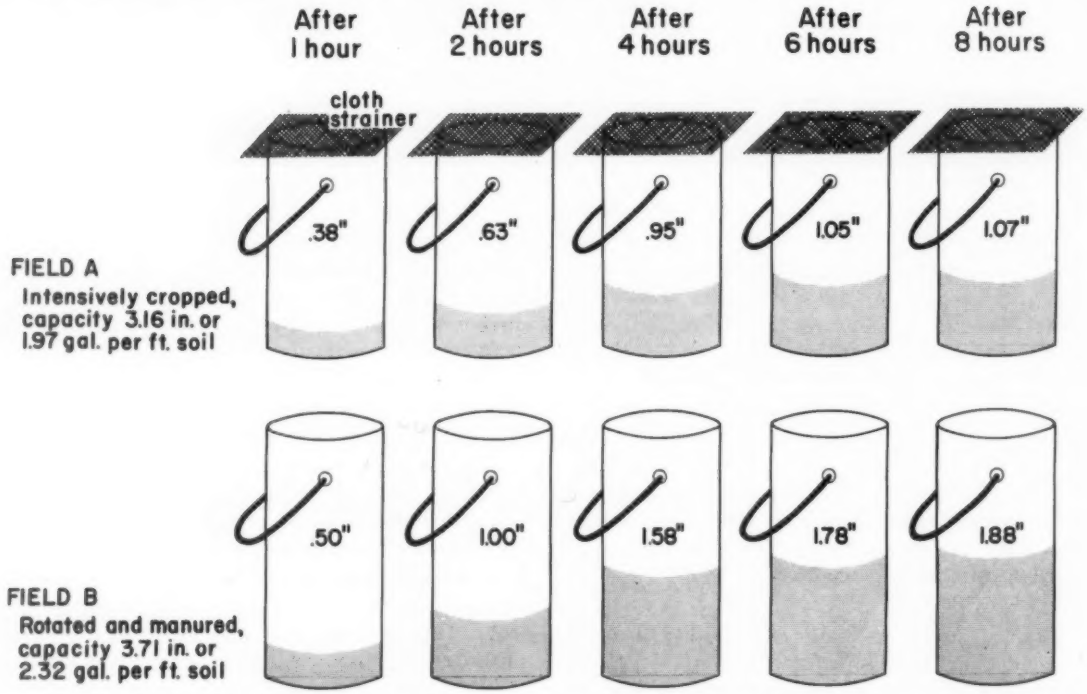
Getting down to Joe's original question about water-holding capacity, this soil does have a little more capacity. It will hold 3.71 inches of rain per foot of depth compared to 3.16 inches for the back forty. The big difference, however, is in the rate of intake, which is much higher where so much more of the soil is in sand-size crumbs.

Let's look at what happens when a storm of common size occurs and when a very large and rare storm comes with little water in the soil. Also, let's see what happens when such a large storm occurs when the soil is already half filled by a prior rain. That should give us a fair picture over a wide range of conditions.

We might imagine that the two fields with different water-holding capacities are somewhat like two milk pails—one holding 3.16 inches (about 2 gallons) and one holding 3.71 inches (about 2 1/3 gallons). The low-capacity one has a slow intake rate, something like a pail with a cloth strainer over it. In the other the intake rate is rapid, as it might be in an open pail. While this is oversimplifying the case, still we can use the actual intake rates and the known capacities of the fields.

The course of the small, common-size storm (4 inches in 8 hours) is diagramed on page 244. During the first hour the intensively cropped field (marked A in the sketch) takes in 0.38 inch and the better-treated field (marked B) takes in 0.50 inch or all the rain that fell. Even though its possible intake rate is 0.92 inch, this is not realized because the rain is less than that amount. At the end of 2 hours the totals are 0.63 inch and 1 inch. During the third hour the rainfall exceeds the declining intake rate on field B as well as on A, and the totals for 4, 6, and 8 hours are those shown on the sketch.

Note.—The author is staff specialist (infiltration), engineering division, Soil Conservation Service, Washington, D. C.



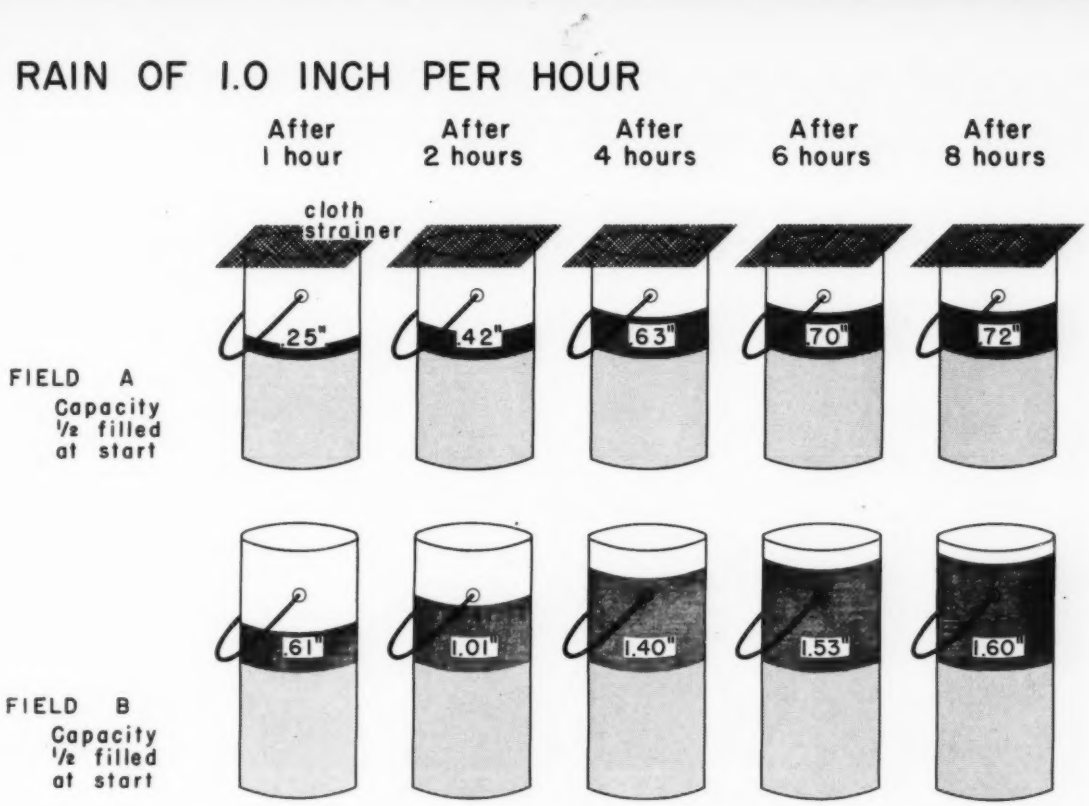
Thus, at the end of the storm the capacity to hold water has not been taxed in either field. Field B is a little more than half full and A about 1/3 full. The remaining water mostly ran off the surface.

A big, rare storm (8 inches in 8 hours, not shown in the sketch) does somewhat the same thing when it occurs at a time when there is little water in the soil. The same amount of water (1.07 inches) goes into the soil of Field A. In Field B the intake is 2.40 inches—somewhat more than before because the larger rate of rain utilizes the full intake possibilities.

If we now assume the same rain occurs when the soil is already half filled by a prior storm, we give it the supreme test. A rain of this size is very rare indeed in the United States, and then only in a few parts such as the southern Gulf Coast. Because one or more prior storms have wetted and packed down the soil, its intake rate is now less than before, being only two-thirds as high. The effects on these two fields, A and B, are somewhat like that shown in the diagram on page 245 where it is seen that half of the capacity is already filled and the additional intake is added to that amount.

During the first hour Field A takes in 0.25 inch and B, 0.61 inch. The intake on B is higher than that on A, hour by hour, as shown in the figure. At the end of 8 hours, A has taken in 0.72 inch and B, 1.60 inches. This almost fills B but A is only about two-thirds filled. The amount of runoff from A is about 7.28 inches while on B it is 6.40 inches.

It is clear that water-holding capacity, as such, is not the controlling element in this sequence of events. Of first importance are the rates of intake of the two fields. Also important is the rate of rainfall, which in the first storm was less than the possible rate of intake of Field B. The total intake is thus reduced by lack of supply. Even if it should be assumed that the rate of intake was not reduced by the prior storms, then it is *Field B* and not A that has its capacity taxed. It is B with its higher intake rate and larger ca-



pacity that first fills. It is the surface condition that is the primary control of amount of water added, in this case.

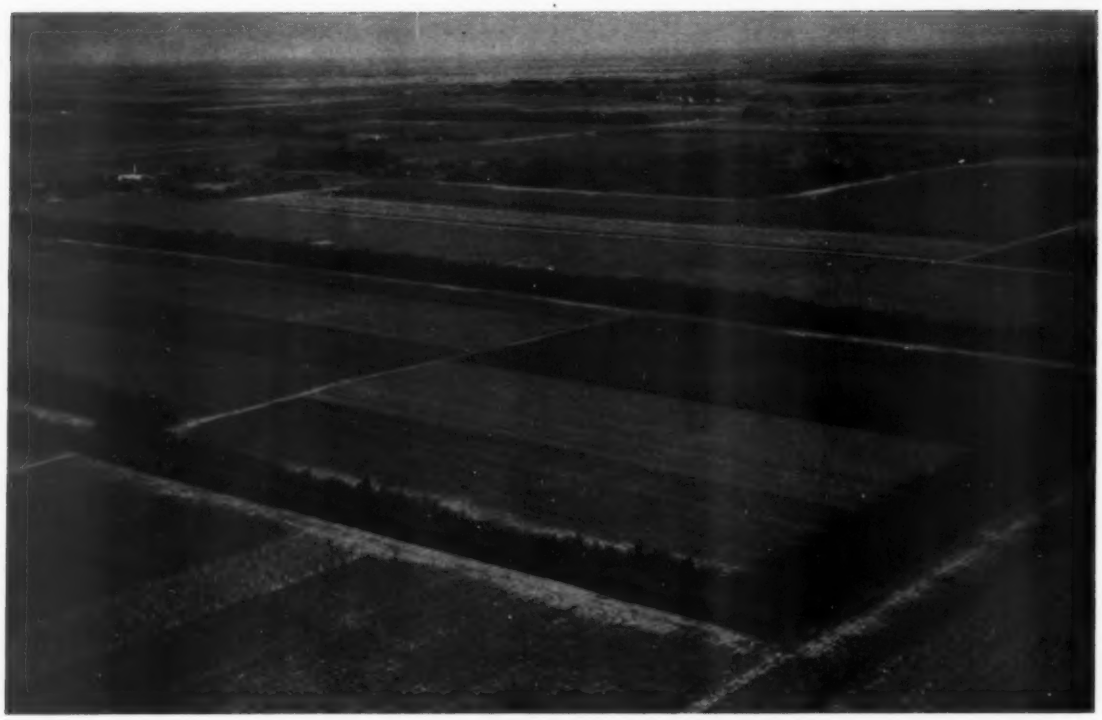
Therefore, the answer to Joe's question (which I think he had already sensed) is that whether for crop production, flood control, or watershed management, the intake rate is all-important.

Fortunately intake rate is one of the things that can be greatly changed, whereas water-holding capacity cannot be greatly changed, at least on a field-scale basis. Growing grass or trees, protecting soil against excess loss of organic matter or where needed, adding organic matter, nearly always improve rates of intake. To increase water-holding capacity in a sandy soil would require the addition of a lot of clay. Adding organic matter has a relatively small effect on capacity. Dr. Peele of the South Carolina Experiment Station, who has studied this thoroughly, has reported that on sandy loam soils each additional percent of organic matter added less than one percent in available water-holding capacity.

In watershed management the treatment of land is not aimed at increasing its water-holding capacity.

Rate of intake, however, often is greatly improved, and thus the rate of movement of the water through the soil to the outlet of a watershed is delayed over that moving on the surface. Surface movement of runoff also may be retarded by land treatment as well as by structures. The overall effect of the things we do to watersheds is temporarily to retard outflow from it. This may seem to some to be an increase in water-holding capacity. The two, however, are not the same. The dense vegetation of forests, grass, crop rotations, and so on promotes intake and retards overland flow of water without necessarily making any great change in capacity of the soil.

Joe did have a good question and one not easy to clear up. He thought that maybe there was too much talk about increasing water-holding capacity of soil. And another thing he said—he was going to change that corn-corn-corn cropping on the back forty!



Enclosed field on T. J. McGill farm southwest of Vernon, Tex.

Which Way Blows the Wind?

This study relates Weather Bureau data to the compass. It should be useful in deciding how to place such conservation practices as stripcropping, shelterbelts and contour tillage to combat the damage from violent air movements.

By C. D. BREHM

WIND erosion of soil may result from a single cause, or from a combination of many factors. It is equally true that the control of wind erosion may be effected by a single practice, or under other conditions require multiple practices and combinations. Thus, are posed many interesting questions.

When we have a full understanding of particle sizes, soil erodibility, surface condition, vegetative cover, and wind velocities—do we have all the answers? Generally, yes. Would a knowledge of damaging wind directions be helpful? Are data on prevailing wind directions satisfactory information for predictions as to the direction from which damaging winds will appear? For the last two answers, it appears that we need more data to go on than is now at hand. Wind directions also are important when wind strips or shelterbelts are used as a control measure.

Wind erosion on cropland is minimized when crop strips, alternate close-growing crops and

Note.—The writer is conservation engineer, Soil Conservation Service, Huron, S. Dak.

row crops or fallow, or shelterbelts are placed at right angles to the direction of windstorms. Planning for the conservation practices of wind stripcropping, contour stripcropping and field shelterbelts, therefore, necessitates a recognition of wind velocities and directions that may cause soil losses.

Crop strips and shelterbelts are usually laid out across the prevailing winds. Actually, there are varying opinions on the best direction for wind stripcropping, even though the prevailing wind directions are known. The pattern of wind stripping varies considerably wherever it is used. Although some crop strips are farmed the long way of the field to reduce machinery turns, many farmers, on the basis of their experiences with heavy windstorms, choose directions calculated to protect their land.

The varying velocities of a windstorm have a somewhat proportional effect on the amount of soil erosion. Smaller particles of soil start moving at velocities approaching 15 miles per hour. As the velocity increases, the erosion also becomes greater. A dry soil lacking proper crop residues and surface roughness will seriously erode when the wind velocities exceed 15 miles per hour and continue for several hours. Since these conditions are common, effective planning of control measures should be based on a full knowledge of all available information. Research indicates that the orientation of wind strips and shelterbelts is a minor consideration, but it still is important. Certainly, a hodgepodge of data on prevailing wind directions and velocities which is a mere compilation of all winds—large and small—is not likely to help. Almost everyone will agree that winds of 15 miles or less, occurring over a period of many days, threaten very little erosion.

There may be some persons who feel that windstorms are most destructive during spring and less damaging during summer and winter. It is recognized that the soil surface usually is protected by plant cover during the summer months, and, in some localities, by snow or ice during the winter. Unfortunately, such coverings cannot be relied upon to protect the soil at all times.

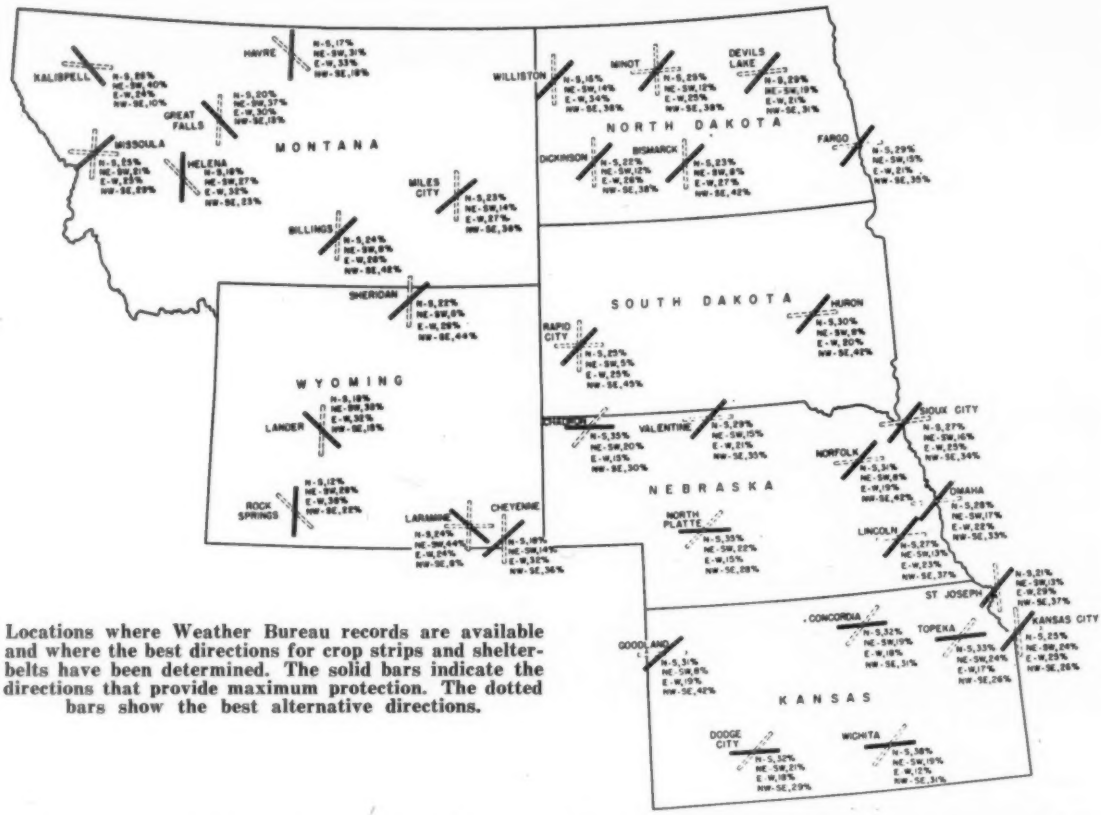
In view of the need for protecting land and crops from damaging winds, a study was made of weather records to see if it was possible to develop useful criteria for the installation of wind protection practices. The primary concern was in getting a guide to the orientation of such practices as shelterbelts, stripcrops, and contour cultivation.

In this study it was assumed that the highest velocity windstorms each month are the most destructive ones. Reports by the U. S. Weather Bureau supply this information wherever there is suitable equipment for recording it. A study of wind conditions would require data comparable to that on rainstorms. Rainstorm data is complete in that the intensity, in inches per hour, is given along with the duration. More data on windstorm velocities, direction and duration would provide the information that is needed by our agricultural technicians. With data limited, however, we had to rely on the single maximum storms at various stations throughout the Northern Great Plains States.

The map I include shows the Northern Great Plains area and summaries of information obtained from various Weather Bureau stations. The percentage of storms in the various quadrants of the compass are shown, as well as bars representing the best direction for wind stripcropping and shelterbelts on flat lands at various stations. If some other direction is desired by the land operator, a comparison of windstorm percentages can be made to determine the best alternative direction. In most cases, the alternative direction does not provide as much protection as the first choice.

This map shows that the direction of high velocity winds varies considerably throughout the region. There may be contrasting variations at stations relatively close together, such as shown for Cheyenne and Laramie, Wyo. Here, the proximity of high mountains probably exerts a marked influence. Elsewhere, local topography of other kinds may have some influence on wind direction. It is for this reason that local weather information should be used to the fullest extent possible in planning wind-erosion control practices.

Where water erosion hazards also are present on sloping land, consideration should be given to contour stripcropping and other appropriate practices to help control both wind and water erosion. Any stripcropping on the contour is usually irregular in its directional



Locations where Weather Bureau records are available and where the best directions for crop strips and shelterbelts have been determined. The solid bars indicate the directions that provide maximum protection. The dotted bars show the best alternative directions.

pattern, so that only a portion of the field may be exposed to the full effects of a destructive windstorm. If a portion of a contour stripped or terraced field lies in the most hazardous wind direction, changes in land use or types of growing crops should be considered on those areas susceptible to wind erosion. Grassed turnrows along roads or field boundaries assist in decreasing wind erosion at the field edges.

Where the most damaging windstorms occur from all points of the compass, perhaps more consideration should be given to narrower width strips than where the wind flow directions are more definite. Additional emphasis then will need be given to stubble mulching or residue cover as a supplemental measure.

The U. S. Forest Service has conducted studies on the directions and mile-hours of all winds in the shelterbelt areas of the Northern Great Plains. From these studies, determinations were made as to shelterbelt orientation which would provide the greatest protection. The high velocity windstorm data presented in this paper show orientation comparable to that obtained by the U. S. Forest Service.

This study of monthly maximum windstorms (wind velocities of 15 miles or more and durations of 2 hours or more) and their directions of flow indicates a need for additional detailed data. It can be seen that further consideration of high velocity windstorms should be given in both the planning and application of conservation practices. Mile-hour and directional data on all high velocity windstorms ultimately may be the best method for determining directional control of soil erosion by wind.

NATIONAL WILDLIFE OFFICERS.—New president of the National Wildlife Federation, elected to his sixth consecutive term, is Claude D. Kelley, of Alabama. Vice presidents are Paul A. Herbert, Robert Miller, and John L. Curran. Directors are William M. Apple, Ira L. Porter, Louis D. McGregor, Howard Stone, and A. E. Riegel. Secretary is Charles H. Callison; treasurer, Louis W. Wendt.

Soil and Water Conservation in Action

By D. A. WILLIAMS

IN our soil conservation program's early phases, emphasis was on keeping soil from moving away. Without by any means neglecting the continuing problem of water and wind *erosion,* we moved to give more attention to sustaining and building *soil fertility.* Still more recently, renewed emphasis has been placed on *water management.* Now, all of these components of modern soil and water conservation as we know and practice it today *hinge on land use.*

Water management, to illustrate, requires that we use measures to take care of the structure of the soil; otherwise, it won't take in the water needed. Very shallow soils, for example, won't hold enough moisture for growing corn, let us say, even if we put on fertilizer, and even if we can irrigate. Many of you have had experience with these difficulties during the recent dry years. And, at the other extreme, certain soils present serious problems of drainage, again calling for intelligent conservation water management to assure their productivity.

I mention this by way of emphasizing something of the complexity of the soil and water conservation job in which you and I are engaged. It isn't one that can be taken care of with a once-over-lightly technique of planning and land treatment, just for the sake of expediency in answering that repeated appeal: "When are you boys going to get out to my place?"

Conservation, in other words, is not "just good farming." All the "good farming" we did before we launched the sound conservation program which we know today in this country did not keep us from damaging and depleting our soils to a dangerous degree. So, as I have said many times before, I don't think we ever again can use the label of "good farming" accurately until it represents the kind of operation that has been reached only after the development and application of a basic conservation farming plan, based on appropriate research and experience and detailed soil surveys.

It comes down to putting first things first. It means laying foundation practices soundly, such as, to mention one, taking care of a fundamental problem of water utilization or water disposal on which to base conservation rotations and other needed practices. It means striking a balance between vegetative and engineering practices, for instance—so we can say, "These are the things that are important" and "Here's about the way we are going to get at them."

Through what thus amounts to a broad-scale program analysis, developed together by the technicians and the soil conservation district supervisors and all the others with whom we work, we can be certain of whittling off a good chunk of the job each year and keep moving toward our main objective of a coordinated soil and water conservation program.

I think the wisdom and effectiveness of this first-things-first approach that has been perfected and refined in the last quarter of a century through soil conservation districts, the Soil Conservation Service and the Department of Agriculture speak for themselves.

I think we all recognize the need for complete and adequate information about soils before going ahead and building the framework of sound vegetative, and structural, practices. So we want to make more effective *use* of our soil survey information. Right now, for example, we are paying particular attention to soil-site correlation in timber and rangeland areas. We need to get over the idea that any old land is good for growing trees, just because it is in Arkansas, let us say, or is good for growing grass because it's in Wyoming. We want to be able to say with certainty which soils are ca-

Note.—Mr. Williams is Administrator of the U. S. Soil Conservation Service, Washington, D. C. This article is adapted from an address delivered at the annual meeting of the Arkansas Association of Soil Conservation Districts in April.

pable of economic timber or grassland production, which is what these soil-site correlation studies are aimed to demonstrate.

We also are getting together some more comprehensive information on the urban and other non-farm use of agricultural land. We want to find out what the trend is with respect to demands upon our definitely limited acreage, nationwide, of good agricultural land, and whether it is good land, poor land or what that is going into suburban developments, factory sites and so on.

All of this sort of information can be most useful in our conservation planning ahead, and all kinds of groups look to us to have such information. You in your soil conservation districts, for example, may anticipate being called upon to contribute your knowledge and experience to such broader problems of land use, even after your immediate goals of basic conservation planning and treatment of your districts' farmland proper have been realized.

Another question is to what extent we should move away from the historical base in our agricultural programs in favor of a land class and capability base. That is something else that will take time to answer. Here, again, we run into the matter of coordination of programs, with an important part played by the soil survey, which will have to be finished, essentially, on a uniform basis.

Let me assure you that I am not for a moment suggesting that we get ahead of ourselves and forget that *immediate* job which we are about. That is, the carrying out of *good, sound soil and water conservation programs* on farms and watersheds, *based on sound basic planning*. We still are losing vast quantities of productive topsoil through water erosion. New gullies continue to riddle too many of our sloping fields each year. The "dust bowl" threat has not yet been erased from the Great Plains, where about 7 million acres of land were damaged by wind erosion in seven states from last November to March 15.

We have, as you know, moved to speed up conservation farm planning by means of progressive planning in the last few years. In other words, recognizing that *tools should not be objectives,* we have made more flexible the progressive development of, and placed more emphasis upon, *sound conservation plans as basic to conservation accomplishment.* Progessive planning, which I feel has accomplished what was intended wherever it has been given practical application, never was meant to be an end in itself, but it is a good way of reaching the goal of more basic plans sooner.

A conservation farm plan is basic, of course, if it does the things that are essential, such as providing for stopping erosion, improving soil fertility and productiveness, and providing for management and best use of farm water.

Adoption of a conservation plan is, of course, a matter of the farmer's decision. One of the first things he naturally wants to know is whether conservation will pay him.

We realize that it is not our job, in the Soil Conservation Service, to undertake comprehensive economic analyses or anything of that sort. But, in taking into account all the elements that go into a basic conservation plan, I think we do share the obligation of showing how conservation benefits will exceed the cost within a reasonable time. It is all part of the essential approach to a coordinated conservation program, farm by farm, watershed by watershed, district by district. That is what you are concerned with as district supervisors and cooperators. It is what we are concerned with as technical conservationists assigned to assist you in your programs.

The principle of a completely coordinated program is not new, and it still is basic. Effective conservation—using the land within its capabilities and treating it according to its needs—cannot be just a soil-engineering operation, for example. In dealing with land-use and water-management problems under varying local conditions, either structural or vegetative measures may be the principal remedy, but generally we find that a close combination of the two types of conservation technology is required.

The Service has been giving increased attention to coordination among the different technical phases involved in our operations, realizing again that we can't do a fully effective job of engineering work or water management, let us say, without understanding soils and plants, and tying the various phases together in working with local people. We now have

people in the States who are responsible for all these elements of technical assistance—in soils, engineering and plant technology. Their business is to understand and give competent help on such respective local problems as, for example, cropland, woodland and water management problems.

The watershed program is not something to take the place of your regular soil conservation districts programs. To the contrary, just about everything you are doing in your districts will be all to the good as you move into watershed programs. This is true of your reforestation and woodland management, pasture improvement and development, crop rotations and cover cropping, contouring, terracing, farm ponds, and so on through the list of familiar practices.

In other words, land treatment goes with or, actually, precedes other watershed protection measures. The more sound and efficient the land use program is on any watershed from the outset, the better. It is the backbone of watershed conservation, as it is of your soil conservation districts' programs.

The policy of the Secretary of Agriculture for administration of the watershed act was announced in mid-March. It marks an important step looking toward pushing ahead with this undertaking in which there is such widespread interest. Local watershed organizations already have asked the Department of Agriculture for help in developing work plans on about 300 small watersheds over the country, and an estimated three times that many altogether are in some stage of consideration in the states.

Secretary Benson's policy statement points out that the initiative for all projects must come from the people in the localities involved, and calls for the development of maximum initiative and responsibility by local organizations.

The watershed program is truly one of the people affected—not a "federal government" program. The local people accordingly must have a real feeling of need for it and be ready and willing to meet the cost-sharing, operation and maintenance and other stated requirements for federal assistance.

I won't attempt to discuss all the policy or other details, which are available to you locally. We all are going to have to become familiar with the details together. I know it is a little hard to shift our thinking, for watershed development purposes, to a project-type approach with the cost-sharing and other details with which some of us may not have had too much experience. But I am sure, from our experience so far in this and the pilot watershed protection projects program, that we may look forward to successful watershed accomplishments through the local-state-federal teamwork that goes into it.

The watershed protection program, like your districts programs, provides a means for truly coordinated teamwork through group action in multiplying our efforts for soil, water, timber and wildlife resource conservation and development.

It is entirely possible that there still are resources in time, labor, equipment and materials that the districts haven't yet drawn upon to the extent they could in furthering your programs of greater service. These may be available from state or other public agencies or from private sources.

Conservation credit, for example, is one important tool for helping to get the job done that certainly should not be overlooked. More such credit facilities are available today from public and private sources than ever before. The 1954 Congress, for example, amended the Water Facilities Act to provide for both direct and insured loans for certain soil and water conserving practices, through the Farmers Home Administration and private banks, in all states. This financial resource for conservation advancement may be drawn upon by both individuals and groups.

Congress also, in 1953, amended the Federal Reserve Act to permit national banks to accept properly managed growing timber as collateral for real estate loans, under certain conditions. And, of course, I am sure that by this time many of you have already become familiar with the new provision in the revised internal revenue law, enabling farmers to treat expenditures for a number of soil and water conservation measures as current expenses that may be deducted, at prescribed rates from farm income for tax purposes.

I feel we can all move forward with renewed enthusiasm to the task that lies ahead.

A Look at Old Lands and New Problems

By EDWARD H. GRAHAM

Terraces at Ravello, Italy, support 3-storied agriculture with trellised grapes above vegetables, fruit trees above the grapes.

Wellington Brink asked me if I would jot down some impressions of our Guggenheim trip for this issue of the magazine. "I know you are going to do some heavy stuff about it one of these days, but I think the folks in the Service would like to know just where you went and something of your impressions while you were away," he said. So herewith a try at filling his request.

FOR some years it had been my good fortune to get around in the Americas. While with the Carnegie Museum at Pittsburgh, Pa., I came to know much of the vegetation of the United States—its forests, grasslands, and desert. In British Guiana I had an opportunity to study tropical American rain forest. With the Soil Conservation Service I learned the effects of use upon soil, plants, and environment throughout the States. I got into Mexico and Central America and traveled the tortuous roads of the Venezuelan Andes with national technicians who were trying valiantly to control erosion in this populous mountain region.

All of this was "new" land, intensively used a relatively short time as human history goes. I became anxious to see some part of the world that had been under heavy human impact for millenia, not centuries. What did soils look like that had been cultivated for thousands of years? In what shape were the slopes, now bare, where the branches of forest trees once touched? Did the herds of antiquity reduce the condition of nomadic ranges beyond the point of recovery? These and many other questions I wanted to try to answer for myself.

The opportunity came with the award of a John Simon Guggenheim Memorial Foundation Fellowship in 1954 for "a comparative study of the use of land resources of certain countries of the new and old worlds." I am deeply indebted to the Foundation for the grant, and to the Service for leave during a critical period of our development. With such help and encouragement Mary and I were on a trans-Atlantic plane bound for Lisbon April 18, a year ago.

Although it is difficult not to cite them as we recall their invaluable help, it is necessary in this brief account to forego naming the many persons—all the Americans abroad and those whose homes were the countries we visited—who made our trip pleasant and profitable. We hope to acknowledge individually at another time the help they gave us, for we shall long remember them.

There was only a short stop at Lisbon, but we got out of the city to see maritime pines dripping resin into ceramic cups for naval stores, and great groves of cork oaks for which the Iberian peninsula is famous. The olive—dendritic emblem of the Mediterranean world—was a common sight, often with wheat as ground cover beneath the trees. This with the characteristic Mediterranean maqui chaparral of shrub oak, Juniper, Ulex, and madrono, told us that we had—overnight, as in a dream—moved out of the New Hemisphere into the world's longest inhabitated region.

A short stop in Madrid allowed, among other things, a visit to the new University City, rising on the battleground of the Spanish Civil War. Here there is a magnificent new Forestry Institute, its architecture modified Egyptian. The Institute houses a modern hydraulics laboratory, the only experimental pulp paper mill in the Mediterranean, with machinery newly installed from Sweden, international experiments in torrent control and many other facilities for learning more about and teaching forestry in its broadest aspects. We were soon on our way, however, to our first major stop—Algiers.

In Algeria we were to make a north-south transect from the Mediterranean coast, up and over the northern range of the Tell Atlas, across the Hautes Plateau, over the Sahara Atlas, and south into the northern edge of the Sahara itself. In the north Atlas range we saw rugged mountains, the higher slopes still clothed in holly oak and Atlantic cedar. Below altitudes of 3,000 to 4,000 feet, long attempts at cultivation have caused serious erosion. The French Government, through its soil conservation technicians, is providing help in a dramatic program of terrace construction and revegetation in this steep terrain. The "banquettes" are a noble effort to rehabilitate abused land. This work, less than 10 years old, plus some

Note.—The author is director, plant technology division, Soil Conservation Service, Washington, D. C.

Part of the family add weight to the threshing sled behind a team of water buffalo in the Nile delta of Egypt.

good looking reforestation begun as early as 1910, shows an acute awareness of the need to attend to the land problems in this mountainous area. At lower elevations, where the hills slope northward to the sea, vineyards were being set on the contour—harbingers of the shape of things to come in North Africa, as contour farming is here at home. And as at home, there is the problem of floods from denuded watersheds. We arrived after a heavy spring rain—probably 100-year frequency, we were told. The washed-out roads, damaged bridges, toppled telephone poles, and erosional debris that filled the streams were little different from what many of us in the Soil Conservation Service have seen in the States.

What we saw in the Tell Atlas somehow struck me as closely related to what we had seen in the Venezuelan Andes 2 years before, perhaps because of the deeply dissected terrain and the fact that in both regions the mountains were densely populated. In the Andes "conuco" farmers practice the shifting cultivation of the tropics; in the Atlas the Moslems follow temperate zone agriculture. In the former case there was year-round growing weather, varied only by dry and wet seasons; in the latter, winter temperatures drop to 30 degrees below zero, with 6 feet of snow. Yet, in both instances increasing populations on the steep slopes cause very difficult land use problems and call for very costly remedies. They illustrate well the problem of mountain lands.

Our travel was largely by plane, at least between major points, because flying and prearrangement with those with whom we wished to work almost doubled the time at our disposal. But we went by bus from Algiers across the mountains to Biskra, then by narrow gauge railroad south to Touggourt. South of the mountains we saw our first Bedouin encampments with camels grazing on the open range that looked like the shadscale desert of Nevada. One of the ancient caravan oases on the north-south African route, Touggourt is now a sizable town, buff colored with adobe and dust.

Southwest of Algiers an extensive construction of "banquettes" checks erosion in the Tell Atlas mountains.

The heavy load of erosional debris carried from the Atlas Range indicates the need for watershed conservation.

The slender minaret of the mosque told us this was Moslem country. A camel trip took us into the knife-edged dunes of the Great Eastern Erg, where we walked in the soft loose sand that composes it. And at Touggourt we saw oasis agriculture at its best. Thousands upon thousands of date palms were neatly spaced in rows with ditches carrying water pumped from artesian strata far below to supplement the original oasis spring. Between the palms there was grain, or vegetables and flowers, or grass for grazing sheep.

Returning northward we retraced our route by train to Biskra, then swung northeast with a stop at Batna, from where we could visit the ruins of the Roman town of Timgad. Once a thriving city of 12,000 or more inhabitants, Timgad vividly reminded us of the vigor of Rome twenty centuries ago and the broad extent of her influence. Wherever we went, from Spain to Syria, from North Africa to England, we were never far from tangible evidence of the great Roman Empire. Even in England today the only straight roads, which cross the country from one end to the other, are resurfaced Roman highways! Roman utilization of water for both domestic and agricultural purposes is worth a thorough study of its own.

On by train through Constantine we reached Tunis, whence we recrossed the Mediterranean

Irrigated date palms exemplify modern oasis agriculture near Touggourt, Algeria, on the north edge of the Sahara.

by plane to Rome. In the large modern building which serves as world headquarters for the Food and Agriculture Organization of the United Nations, I talked with many of the agricultural leaders in this highly respected agency. A trip south of Rome disclosed the flat, productive fields that once were the Pontine marshes—drained by Italian engineers in Mussolini's day. And near Salerno, on the steep

calcareous slopes above the Mediterranean, we saw the most intensive cultivation of the trip. Supported by rock terraces, the result of untold human effort, were small flats of man-made soil. Vegetables on the ground, grapes trellised overhead, with fruit trees protruding above the grapes, this three-tiered agriculture is a marvel of hard toil and patience. Class VIII land is here transformed to Class I. No mechanical agriculture could possibly support so many people per unit of land.

Another flight and we were in Athens. Greece is a splendid example of technical teamwork between its own forces and those of the United States. In all aspects of land and water use—cropland agriculture, range conservation, forestry, water management—solid planning and application have increased production from a base of 100 for the years 1935-38 to 166 in 1954.

Twenty four hundred years ago Pericles built the Parthenon. For longer than that the hills of Greece have been lumbered and grazed. In the high mountains, as on Mt. Olympus, there are still forests of pine, oak, and chestnut, but the trees have long since disappeared from all but the most remote sections. We traveled by auto from Athens through the plains of Thessaly and Macedonia to Salonika and farther north to within a few miles of the Bulgarian frontier. We saw severe erosion and debris-choked streams. But we also saw reforestation, improved range management, large drainage and irrigation schemes in the valleys, crop rotations, contour cultivation and torrent control. And on the age-old alkaline river flats near Thermopylae, recently reclaimed soil had helped to change Greece from a rice-importing to a rice-exporting country in 5 years' time. The course is scarcely charted, and there is a long way to go, but more than a fair start has been made by the courageous Greeks.

In Egypt it was a thrilling experience to walk the soil of the Nile Delta and to recall that this very place has been in continuous cultivation for 6,000 years or more. All about was intense activity—almost all hand labor. Water is still raised from the canals to the fields by hand-turned Archimedean screws; the soil is turned by the wooden Egyptian plow; wheat is harvested by water buffaloes slowly circling a sled disk over the cut stalks. In this area of 6 million acres there live 2,500,000 cattle and 20 million people. And the people increase. There are plans to raise the Aswan dam, thus bringing 2 million acres of higher land into cultivation. It is of interest that yields of the major crops—wheat, cotton, Egyptian clover—are higher than U. S. averages. The Egyptians excel in per acre yields while we, of course, exceed them in production per man.

A hundred miles west of Alexandria we put up in one of former King Farouk's rest houses, now field headquarters for the Desert Institute, organized under the powerful Egyptian Production Council. Here is the site of a magnificent attempt to improve Egypt's desert range. Grazed by herds of Arab nomads for no one knows how long, the depleted vegetation of this semiarid land presents a major problem to the range conservationist. With some assistance from U. S. technicians, the Egyptians have established a 2,500-acre enclosure to study the effects of protection from grazing, water spreading, reseeding, and pump irrigation of small areas for supplemental feed. The Arab sheiks are working with the Institute and closely watching the results. The work was in its first year, so it is yet too soon to tell what will come of it. From our own improvements in range condition, however, it is reasonable to expect the Egyptian experiments to prove fruitful and all the more exciting if this ancient range can be at all improved.

We flew from Cairo to Beirut, Lebanon, a favorite city of Americans in the Near East, and the home of American University, one of the leading centers of higher learning for Moslem scholars. Here I took part in a UNESCO conservation conference and met representatives from eight countries of the Middle East. There is an awakening interest in natural resource management throughout this region. Lebanon itself presents a story of land use since the earliest period of human history. A sacred grove of Cedars of Lebanon, preserved within a masonry wall, while all around are stony, eroded slopes, is in itself a solemn lesson in what man can do to his environment. The terraces, ancient and modern, that are so characteristic of this antique land, are in themselves of great interest.

For many centuries the terraced hills of Lebanon have yielded fruit, grain, and other crops.

It is but a short drive eastward from Beirut to Damascus. One crosses the Liban Range, with its terraced grain, vegetables, and fruit, the broad Bekka—a fertile rift valley at 3,000 feet—and then the Anti-Liban Range, to drop into the arid plains of Syria. Damascus is one of the world's oldest continuously inhabited places, and perhaps its largest oasis. Here a full-fledged river rises from the hills to water an area 5 to 10 miles wide and 40 miles long. All around this area is the desert, with a rainfall of not more than 8 inches per year. But where the water flows are crops, pastures, and fruit—even irrigated woodlots producing willow and cottonwood for fuel, construction, and furniture. Throughout Syria FAO technicians are helping to work out solutions to various land use problems, and we saw their work in the irrigated section and the desert as well.

Our next stop was Turkey. Here modernized Islam presented strong contrast to the other Moslem countries we had seen. Arriving by air at Istanbul, we found an Arabian Nights' city dominated by huge and splendid mosques, and what must be the world's most phrenetic harbor. Thence, by train we traveled to the new capital of Ankara in the rolling Anatolian Plain. At Ankara I took part in an FAO-University of Ankara conference on range, pasture, and forage development, which brought leading Middle East technicians together for a workshop on improved plant technology in the Mediterranean. After the conference we got into the field to see something of Turkish agriculture and native range. One-half of Turkey is grazing land, and the home of many of the world's most widely used forage crops, such as alfalfa, burclover, sweetclover, and many of the common trifoliums. A great deal has been made of the mechanization of Turkish agriculture. We saw some evidence in the extensive wheatlands of the plateau that the rapid changeover to use of heavy farm equipment was increasing the

erosion hazard, and some of the agricultural technicians in Turkey are concerned about the matter. There are invariably problems arising from the impact of western technology upon countries and peoples who are suddenly subjected to it.

Back at Istanbul we again took to the air for Rome, thus completing our circle of the Mediterranean. In Rome we further discussed with FAO officials what we had seen and what it meant. From here our plan called for travel by car northward through western Europe. We crossed the Apennines and dropped into the great Po Valley, Italy's prime farm area. The agriculture of this broad productive alluvial plain is in strong contrast to the abused mountainous part of the country south of Rome. Thence, into southern France and up the Rhone valley to Paris, where we attended the VIIIth International Botanical Congress.

After the Congress we drove to Switzerland, to spend several days with the foresters of the Swiss Technical Institute. I had long wanted to see the managed forests that represent some of the world's most progressive thinking in forest management. The Swiss combine a detailed knowledge of plant ecology with hardheaded practical realism in forestry, and I learned firsthand something about "femelschlag" and "plenterwald" methods. The trees themselves were a delight. Silver fir and Norway spruce better than 3 feet DBH reach 120 feet straight toward the sky. Swiss forestry is a good example of what we have to learn from others.

In the area below Damascus wood, as well as forage and cultivated crops, is produced from irrigated fields.

The ruins of Timgad in northwest Algeria illustrate extensive Roman occupancy of north Africa before the fall of the Empire.

Our route took us to Innsbruck, Munich, and down the Rhine valley into the Netherlands, where we wanted to get a look at the justly famous reclamation work that has literally made the country. At Wageningen—the Netherlands' Beltsville—we were graciously received and were accompanied on a circuit of Holland, which permitted us to see firsthand its woodlands, heather, unbelievably productive pastures, cultivated fields and bulb land. "This is a millimeter country," we were told by the Dutch, and their delicate manipulation of water, intimate knowledge of soil-plant relationships, and scientific approach to all land and water problems is ample proof of the contention. Back of it all, starting in the 13th century, their fight against the North Sea is culminating in the enclosure and drainage of the Zuyder Zee, still in progress. Almost half the country would be flooded by sea water if it were not for the coastal dunes and dikes. I can imagine no more productive example of human ingenuity and perseverance than the things the Dutch have done with their land.

From Holland we drove to Brussels—where we learned more about European vegetation surveys—and to Ostend, where we took the ferry to Dover, thence on to London. Here it was possible to learn something of the agri-

cultural and land use programs of Her Majesty's government, and to meet many of her public servants. From London we were within striking distance of Rothamsted, the world's oldest agricultural research station, as well as Cambridge and Oxford Universities, all of which we visited. At the latter I was a guest of the Bureau of Animal Population, whose work has long been familiar to American ecologists. We also got into the rolling farmlands of the Salisbury Plain west of London, and the reclaimed fenland to the north of the metropolis.

Before heading home we flew from London to Copenhagen to attend the Fourth General Assembly of the International Union for the Protection of Nature—the world's only international conservation congress. I was able to participate in the formation of the Union's Commission on Ecology and we joined the excursion which permitted a good look at Denmark and its countryside. This little country is one of the leaders in adopting legislation to establish protected areas for recreation, landscape beautification, and biological research.

At last, 5 months to the day that we left New York, we returned by air, via London and Glasgow. Our trip was a reconnaissance, of course, but we got a good look at some major land problems and what is being done toward solving them. And in addition to innumerable impressions we have real booty in five volumes of notes and a large cache of photographs, both kodachrome and black and white. Most important of all, we established a base for a more thorough understanding not only of the Old World's land resources but our own as well.

Radioactive Isotopes Help Solve Field Problems

By J. C. BROWN and R. S. HOLMES

FRUIT orchards growing on calcareous soils in the western states are frequently afflicted with a serious yellowing of the leaves known as lime-induced chlorosis (fig. 1).

There is a tremendous body of evidence that the trouble is due to the inability of the plant to absorb iron from the soil for use in the growth processes of the plant. Iron may be absorbed in some plants, but later becomes inactivated in the plant and unavailable for growth. Use of radioactive isotopes in research on this problem has afforded a much better understanding of the nutritional difficulties that bring about lime-induced chlorosis.

When radioactive iron was initially present in soybean seed, an autoradiograph (fig. 2) showed that sufficient radioiron was supplied from the seed for growth of the plant on a calcareous soil until the two trifoliate leaves developed. These leaves became chlorotic. The autoradiograph was made by placing the plant in contact with X-ray film in the dark. Radioemanations from the iron expose the film, so

Figure 1.—Chlorosis in a peach orchard; typical of chlorosis-susceptible plants in numerous irrigated valleys in the western states.

Note.—The authors are soil scientists, soil and water conservation research branch, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Md.

that a light image illustrates where radioiron is concentrated and a dark, poor image reveals a low level of iron. The chlorotic leaves contained much less iron than the rest of the plant. There was not sufficient iron absorbed and translocated from the calcareous soil to the leaves to prevent chlorosis.

Figure 2.—Autoradiograph which shows the distribution of radioiron from the cotyledons to other parts of a chlorosis-susceptible soybean grown on a calcareous soil. The two trifoliate leaves developed chlorosis and contain less radioiron than the other parts of the plant.

Radioiron was added to the calcareous soil, as ferric chloride, to determine if this iron would remain available for plant growth. Chlorosis-susceptible soybeans were grown on this soil, but they became chlorotic because they were unable to absorb sufficient iron from the soil. This is shown by the autoradiograph (fig. 3) revealing a little radioiron in the roots and lower stems, but practically none in the leaves. That is, the added radioiron was fixed in the soil in an unavailable form.

A chelate, DTPA (diethylenetriamine pentacetic acid) was applied to the soil to determine if it would make the radioiron, *previously added*, available to the plants. Figure 4 is an autoradiograph of the chlorosis-susceptible soybean which shows that the chelate did make

Figure 3.—Autoradiograph which shows the inability of chlorosis-susceptible soybeans to absorb radioiron from a calcareous soil. Note radioiron in roots and lower stems.

No. 4

This is the fourth of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

Figure 4.—Autoradiograph which shows the ability of the chlorosis-susceptible soybeans to absorb the radioiron from the calcareous soil after the soil was treated with chelate DTPA. Note concentration of iron in the leaf and flower primordia.

the radioiron available and prevented chlorosis. Chelates are chemical compounds which combine with the iron in the soil in such a way as to prevent it from reacting to an unavailable form with other chemicals in the soil. Iron as a chelate was available to plants and the latter developed normally with a good green color (fig. 5). The green plant on the right received chelate while the chlorotic one on the left did not.

The chelate was utilized in making iron already present in the soil available to the plants (fig. 6). Soils which did not contain radioiron, but were treated with DTPA tagged with radioactive carbon, showed that radiocarbon was absorbed and translocated into the leaves, presumably as the chelate. The autoradiograph shows that this radiocarbon was distributed throughout the plant in equal concentration. This indicates that the chelate molecule or some fraction of it is effective in carrying iron from high-lime soils into and through the plant.

Chelate applied at the same rate to a number of different soils produced toxicity symptoms

Figure 5.—A photograph which shows plant response to chelate DTPA added to a calcareous soil. Left, no chelate. Right, chelate added to the soil.

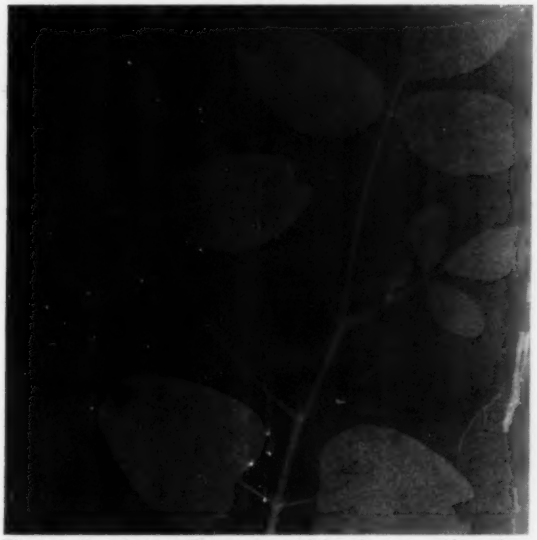


Figure 6.—Autoradiograph which shows radiocarbon of C14 tagged DTPA distributed throughout the chlorosis-susceptible soybean. The chelate was utilized by the plant in making soil iron available.

Figure 7.—Leaves from chlorosis-susceptible soybeans grown on soils which received different amounts of chelate. Left, chlorotic leaf; no chelate. Center, green leaf; chelate added to soil. Right, leaf showing toxicity symptoms where too much chelate was added to the soil.

in the plant on some soils, alleviated chlorosis in others, and was only partially effective in

alleviating chlorosis in a third group of soils. This showed the variable effect of the nature of the soil in determining chelate efficiency.

Similar results were obtained by adding the chelate to a soil at different rates (fig. 7). With no chelate in the soil the plants were chlorotic. As the amount of chelate applied to the soil was increased, the plants became green. When still more chelate was added to the soil the plants developed toxicity symptoms. New chelates are constantly being developed which appear more efficient and less toxic than those that have been used. Much additional research is needed before recommendations can be safely made for field applications of chelates to calcareous soils, but current studies have revealed a promising solution to an exasperating field problem.

Several commercial iron-chelate compounds, which have been used successfully in the East, have not been helpful on the western calcareous soil. But, several recent experimental types of chelates appear to offer promise for the western problems on iron nutrition of plants.

Brush Control

By HARLAN N. TULLEY

THE rotary brush cutter is coming into prominence as a tool for range improvement. With this machine about 2 acres per hour of medium heavy brush can be cleared. The cut material is deposited on the soil as a mulch, thus providing the same soil protection as the standing brush. This provides an excellent seedbed for seeding grass, an advantage if there is not sufficient native grass already present. As might be expected, the best results are obtained on the better soils and gentle slopes. To prevent having weedy annual growth replace the brush, it is necessary to give the treated land rest from grazing during the two growing seasons after cutting to allow establishment of a full grass cover. Fall grazing is permissible during this time.

The kinds of brush, such as rabbitbrush, willows and greasewood, that sprout under the ground are not successfully controlled this way. But sagebrush is easily killed since it sprouts above ground.

Experiments conducted in Wyoming indicate that brush control on native range increases forage production the first year by 20 to 80 percent. After 2 years, the forage production goes up 100 to 200 percent. In Colorado, it was increased 2 to 3 times by this method.

One type of machine used to cut brush on rangeland. It uses two power-driven rotary blades which pulverize the brush and drop it on the ground as a mulch. Another popular type of brush cutter is the rotary beater which flails the brush to the ground and leaves it there as a mulch.

In Oklahoma, good sagebrush control was obtained only when the plants were cut close to the ground in June during 2 successive years, and livestock kept off the range from June until fall. Grass density increased 90 percent and carrying capacity 80 per cent. The gain per head was 4 percent and the gain per acre was 76 percent. This increase, coupled with the increased selling price of the cattle due to better physical condition, resulted in double the former return.

June is the best month to cut brush, as it has been found that plant food reserves within the plant are lowest at that time and the plants are most susceptible to control.

Note.—The author is range conservationist, Soil Conservation Service, Sheridan, Wyo.

REVIEWS

FLOODS. By William G. Hoyt and Walter B. Langbein. 469 pp. Illustrated. 1955. New Jersey: Princeton University Press. $7.50.

TWO hydraulic engineers, well-known in their profession, have written an excellent book on a subject of interest to every farmer and rancher.

It is natural that Hoyt and Langbein, being engineers, should lean toward the opinions of their colleagues on such matters as conservation and small dams. Yet the authors have tried to be impartial, and after promising us bigger and more ghastly floods on the populated valley lands in the future, they offer flood plain zoning, insurance, and forecasting as the eventual solutions to floods on the larger streams. For the smaller streams, they admit that small dams will do some good, but turning the upstream bottom lands into pasture seems the ideal solution to them. Corn Belt farmers may disagree—perhaps their best counter-argument is in terms of steaks from corn-fed steers.

The book was written before both the pilot watershed program and the Hope-Aiken legislation were in operation. This omission in the otherwise comprehensive text is not serious. Five or so years hence, when the effects of the watershed protection projects will be known, Hoyt and Langbein will have new and useful information to add to the second edition.

The book is handsome and its contents well organized. The ten chapters give you such generally unavailable information as the generation and life history of floods; the damages suffered from past floods in the United States and how such damages are determined; a review of legislation and present flood control policy (to 1953); and such useful reference data as the problems, projects, and plans of the major watersheds of the nation, with maps showing sites of proposed and existing large dams, and an historical review of past floods.

Most important of all, there is a review and discussion of what has been done about flood prevention in the past, and what can be—or ought to be—done about floods in the future. The authors have tried to avoid getting into the controversy about big and little dams in their discussion of flood remedies. Another part of the controversy, however, shadows a few of the pages and the neutrality of the authors wavers when they discuss "Stopping the little raindrops where they fall" as a solution to flooding on major streams.

The reluctance of Hoyt and Langbein to accept "land use practices" as a major flood prevention method is based on the lack of streamflow data from conservation treated *large* watersheds. The authors, whose life work has been in connection with the *measurement* of streamflow, are therefore unimpressed by the claims of enthusiasts who have only *seen* conservation work on their own farms or ranches. Measurements are the heart of an engineer. Thus, the evaluation programs now being installed on selected watershed protection projects have an importance greater than their money value. As instruments of persuasion in the engineering field, the measurements now started will be decisive factors in settling controversies—or continuing them. Every conservationist should watch with interest the establishment of conservation practices on those projects.

This book should be owned and read by every conservationist for the facts and the thought-provoking statements that are contained in it, for the book represents—as nearly as possible, these days—a neutral opinion on an important subject.

—VICTOR MOCKUS

THE grass is rich and matted, you cannot see the soil. It holds the rain and the mist, and they seep into the ground, feeding the streams in every kloof. It is well tended, and not too many cattle feed upon it; not too many fires burn it, laying bare the soil. Stand unshod upon it, for the ground is holy, being even as it came from the Creator. Keep it, guard it, care for it, for it keeps men, guards men, cares for men. Destroy it and man is destroyed.

—Alan Paton in "Cry the Beloved Country"

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PUBLIC LIBRARY
MAY 24 1955
DETROIT

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

Big Job Well Done!

NOT in all the history of Scout "good turns" since 1912 have 3 million boys attracted so much interest as during 1954, when 135,000 special projects were carried out in an effort to arouse public recognition of the need for adequate protection and management of America's soil, water, forest, mineral, and wildlife resources.

In February this year 12 Regional Explorers came to Washington and made their "Report to the Nation" to President Eisenhower at the White House. They told the President what Scouts did in conservation during 1954.

Activities included 41,721 projects in soil and water conservation, more than 29,000 in fish and wildlife conservation, 38,125 in forestry, and 30,450 in outdoor manners.

During 1954 Cub Scouts, Boy Scouts, and Explorers planted 6,192,753 trees over the country, mostly on eroded or abandoned land. If these trees had been planted in one straight row they would reach from New York to Honolulu. More than 561,675 hours were spent by Scouts helping conservation officials in outdoor-manners campaigns—cleaning up roadsides, parks, campgrounds, lake sides, streams and other recreation areas. More than 3 1/3 million conservation posters were posted during the year—enough to cover the walls of 2,500 five-room houses.

This isn't all. More than 55,000 nesting boxes for wood ducks, squirrels, raccoons, and songbirds were built and setout.

President Eisenhower receives leather-bound report on "Good Deeds." With him: John R. Cookerly, David L. Gerwitz, Charles L. Braun, and James Noblin.

Wildlife was dramatized by both Boy and Girl Scouts. Scouts love birds, animals and fishes. Their projects in fish and wildlife management were for the improvement of the natural environment. Some of the projects purposed to improve sport fishing.

Millions of people were alerted to the conservation needs of our nation, many for the first time. Eleven TV film "trailers" were distributed to 300 stations from coast to coast during the year. These films were used more than 20,000 times, a total of more than 800 hours devoted to the Conservation Good Turn.